Topic 27S

20.2.50.116 Equipment Leaks & Fugitive emissions

NMOGA

NEW MEXICO OIL AND GAS ASSOCIATION

NMED Ozone Rulemaking Hearing

Surrebuttal Testimony of John R. Smitherman
Senior Advisor

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- NMED believed that NMOGA’s analysis lacked specificity.
- NMED has challenged some of the bases of our analysis
- I will address a list of criticisms and responses for the Board’s edification

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- **Well Sites**

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- ERG’s analysis is flawed
  - **Emissions reductions are over-estimated**
    - Model Plant is flawed (Major equipment counts are high hence component counts are high hence emissions are high)
    - Leak frequency is flawed
  - **Costs are under-estimated**
    - Results are cost per ton of emission reductions that are too low and not reflective of reality
  - **Costs: important to the viability of O&G industry**

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- Emissions reductions are over-estimated

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- **Critiques of LDAR analysis**
- NMED cannot evaluate the validity or representativeness of the alternative model plants mentioned by NMOGA, because NMOGA does not document in its testimony or exhibits the actual model plants they created and on which they estimated new emission reductions and cost effectiveness numbers.
- **Response**: NMOGA did provide the GHGRP file (Exhibit NMOGA27) that was used to construct the more current and representative model plants. This data is also publicly available. In surrebuttal, NMOGA will provide additional information on these model plants.

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What is a Model Plant?

- A model plant is a statistically "average" facility
  - An average number of equipment types (wells, separators, heater treaters, etc.)
  - An average number of components per equipment type (valves, open ended lines, pressure relief valves, etc.)
  - Results in an average number of components per site

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- **<u>Emissions over-estimated at Well Sites, Model Plant</u>**
  - ERG's Model Plant
    - Based on 1996 EPA/GRI study
      - Not representative of NM Well Sites
  - NMOGA Model Plant
    - Based on latest (2019) GHGRP data from NM
      - Fewer equipment, fewer components, lower potential leak emissions than ERG used
  - NMOGA data is specific to San Juan Basin and Permian Basin Well Sites

Criteria	ERG Model Plant	NMOGA Model Plant
Date of Data Development	1996	2019
Geographic Scope	Not Specific to New Mexico	Specific to San Juan and Permian Basin

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NMOGA Model Plant - Well Sites

Average Fugitive Emissions Component Count for Natural Gas Well Site Model Plant - GHGRP Data

Equipment	Model Plant Equipment Counts[b]	Average Component Count per Equipment[a]				Average Component Count per Model Plant			
		Valves	Connectors	OELs	PRVs	Valves	Connectors	OELs	PRVs
Gas Wellheads	2	9.5	37	0.7	0	19	74	1.4	0
Separators	1.91	21.6	68.5	3.7	1.2	41.2	130.8	7.1	2.3
Meters/Piping	2.02	12.9	47.8	0.5	0.5	26.1	96.7	1.0	1.0
In-Line Heaters	0.04	14	65	2	1	0.6	2.6	0.1	0.0
Dehydrators	0.01	24	90	2	2	0.3	1.0	0.0	0.0
Compressors[c]	0.44	73	179	3	4	32.4	79.5	1.3	1.8
Heater-Treater[c]	0.00	8	12	20	0	0.0	0.0	0.0	0.0
Header[c]	0.01	5	10	4	0	0.0	0.1	0.0	0.0
		Total				119.6	384.6	11.0	5.1
		Rounded Total				120	385	11	5

[a] Data Source: EPA/GRI. CH4 Emissions from the Natural Gas Industry, Volume 8: Equipment Leaks, Table 4-4 and 4-7, June 1996. (EPA-600/R-96-080h)
[b] Data Source: 2019 GHGRP Data Accessed Through Envirofacts: San Juan basin counts were used for natural gas well model plants which conforms with the ERG assumption that all natural gas wells were in the San Juan basin.
[c] Data Source for component counts for compressors - Subpart W, Table W-1B; For heater-treaters, and headers - Subpart W, Table W-1C

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NMOGA Model Plant – Well Sites

Average Fugitive Emissions Component Count for Oil Well Site Model Plants - GHGRP Data											
Production Equipment	Model Plant Production Equipment Counts	Average Component Count Per Unit of Production Equipment[a]					Average Component Count Per Model Plant				
		Valves	Flanges	Connectors	OELs	PRVs	Valves	Flanges	Connectors	OELs	PRVs
Oil Well Model Plant (< 300 GOR)[b]											
Oil Wellheads	2	5	10	4	0	1	10	20	8	0	2
Separators	0.90	6	12	10	0	0	5.4	10.8	9.0	0.0	0.0
Headers	0.41	5	10	4	0	0	2.0	4.1	1.6	0.0	0.0
Heater/Treaters	0.36	8	12	20	0	0	2.8	4.3	7.1	0.0	0.0
In-Line Heaters	0.02	14		65	2	1	0.3	0.0	1.3	0.0	0.0
						Total	20.5	39.1	27.0	0.0	2.0
						Rounded	21	39	27	0	2
Oil Well Model Plant (≥ 300 GOR)[b]											
Oil Wellheads	2	5	10	4	0	1	10	20	8	0	2
Separators	0.90	6	12	10	0	0	5.4	10.8	9.0	0.0	0.0
Headers[c]	0.41	5	10	4	0	0	2.0	4.1	1.6	0.0	0.0
Heater/Treaters[c]	0.36	8	12	20	0	0	2.8	4.3	7.1	0.0	0.0
Meters/Piping	0.26	12.9	0	47.8	0.5	0.5	3.4	0.0	12.5	0.1	0.1
In-Line Heaters	0.02	14		65	2	1	0.3	0.0	1.3	0.0	0.0
Compressors[c]	0.05	73		179	3	4	3.4	0.0	8.4	0.1	0.2
Dehydrators	0.00	24		90	2	2	0.0	0.0	0.1	0.0	0.0
						Total	27.4	39.1	48.0	0.3	2.3
						Rounded	27	39	48	0	2

[a] Data Source: 2019 GHGRP Data accessed through Envirofacts for major equipment counts: San Juan basin counts were used for natural gas well model plants which conforms with the ERG assumption that all natural gas wells were in the San Juan basin.
[b]Data Source for component counts: 40 CFR Part 98; Subpart W; Tables W-1B; and W-1C

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ERG/CTG Model Plant – Gas Well Sites

Table 9-4. Average Fugitive Emissions Component Count for Natural Gas Well Site Model Plant

Equipment	Model Plant Equipment Counts	Average Component Count per Equipment[a]				Average Component Count per Model Plant			
		Valves	Connectors	OELs	PRVs	Valves	Connectors	OELs	PRVs
Gas Wellheads	2	9.5	37.0	0.7	0.0	19.0	74.0	1.4	0.0
Separators	2	21.6	68.5	3.7	1.2	43.2	137.0	7.4	2.4
Meters/Piping	3	12.9	47.8	0.5	0.5	38.7	143.4	1.5	1.5
In-Line Heaters	1	14.0	65.0	2.0	1.0	14.0	65.0	2.0	1.0
Dehydrators	1	24.0	90.0	2.0	2.0	24.0	90.0	2.0	2.0
					Total	138.9	509.4	14.3	6.9
					Rounded up Total	139	510	15	7.0

[a] Data Source: EPA/GRI. *CH_4 Emissions from the Natural Gas Industry, Volume 8: Equipment Leaks*, Table 4-4 and 4-7, June 1996. (EPA-600/R-96-080h)

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ERG/CTG Model Plant – Oil Well Sites

Table 9-5. Average Fugitive Emissions Component Count for Oil Well Site Model Plants

Production Equipment	Model Plant Production Equipment Counts	Average Component Count Per Unit of Production Equipment[a]					Average Component Count Per Model Plant				
		Valves	Flanges	Connectors	OELs	PRVs	Valves	Flanges	Connectors	OELs	PRVs
Oil Well Model Plant (< 300 GOR)[a]											
Oil Wellheads	2	5	10	4	0	1	10	20	8	0	2
Separators	1	6	12	10	0	0	6	12	10	0	0
Headers	1	5	10	4	0	0	5	10	4	0	0
Heater/Treaters	1	8	12	20	0	0	8	12	20	0	0
						Total	29	54	42	0	2
Oil Well Model Plant (≥ 300 GOR)[b]											
Oil Wellheads	2	5	10	4	0	1	10	20	8	0	2
Separators	1	6	12	10	0	0	6	12	10	0	0
Headers	1	5	10	4	0	0	5	10	4	0	0
Heater/Treaters	1	8	12	20	0	0	8	12	20	0	0
Meters/Piping	3	12.9	0	47.8	0.5	0.5	39	0	144	2	2
						Total	68	54	186	2	4

[a] Oil well (<300 GOR) component counts obtained from 40 CFR Part 98, subpart W, Table W-1C.
[b] Oil well (≥300 GOR) component counts obtained from 40 CFR Part 98, subpart W, Tables W-1B and W-1C.

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- **Emissions reduction from LDAR**
  - From NSPS OOOOa Tech Support Document (averaged/rounded)

Frequency	Emissions Reduction (%)
Annual	40%
Semi-Annual	60%
Quarterly	80%
Monthly[a]	90%

[a]NMOGA developed the reduction percent for monthly OGI surveys from the ERG Method-21 percent of 92% for Method-21 minus 2% which accounts for the difference between OGI and Method-21 percent for quarterly OGI surveys.

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- **Emissions reductions over-estimated at Well Sites**

Estimated Reductions Comparison - Tons Per Year VOC						
	ERG (CTG Basis)			NMOGA (GHGRP Basis)		
	Gas Well Site	Oil Well Site <300 GOR	Oil Well Site >=300 GOR	Gas Well Site	Oil Well Site <300 GOR	Oil Well Site >=300 GOR
Annual	0.61	0.13	0.3	0.509	0.096	0.122
Semiannual	0.917	0.199	0.451	0.764	0.143	0.183
Quarterly	1.222	0.265	0.602	1.018	0.191	0.244

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- **<u>Emissions reductions over-estimated at Well Sites</u>**
  - Differences in potential emissions reduction are significant
    - For quarterly OGI surveys GHG(NMOGA):
      - Gas well sites – 16.7% lower
      - Oil well sites <300 GOR – 27.9% lower
      - Oil well sites =>300 GOR – 59.5% lower
  - Board should use recent, NM-based data

Sample Calculation						
(1.222	-	1.018)	/	1.222	* 100 =	16.7%
ERG TPY Gas well sites Quarterly		NMOGA TPY Gas well sites Quarterly		ERG TPY Gas well sites Quarterly		Percentage Decrease in Emissions Reductions

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- **Emissions reductions over-estimated at Well Sites**

Costs of VOC Reductions - $ per ton of VOC reduced -						
	ERG (CTG Basis)			NMOGA (GHGRP Basis)		
	Gas Well Site	Oil Well Site <300 GOR	Oil Well Site >=300 GOR	Gas Well Site	Oil Well Site <300 GOR	Oil Well Site >=300 GOR
Annual	$2,243	$10,343	$4,552	$2,686	$14,267	$11,226
Semiannual	$2,592	$11,954	$5,260	$3,124	$16,605	$12,975
Quarterly	$3,588	$16,553	$7,285	$4,299	$22,960	$17,973

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- **<u>Emissions reductions over-estimated at Well Sites</u>**
  - Impact on $/ton of VOC reductions (ERG cost basis while using data that better characterizes NM operations for emissions reduction potential)
  - For quarterly OGI surveys:
    - Gas well sites – 19.8% higher
    - Oil well sites <300 GOR – 38.7% higher
    - Oil well sites =>300 GOR – 146.7% higher
  - ERG's emissions estimates understate NM actuals

Sample Calculation						
($4,299	-	$3,588)	/	$3,588	* 100 =	19.8%
NMOGA Cost/Ton Gas Well Sites		ERG Cost/Ton Gas Well Sites		NMOGA Cost/Ton Gas Well Sites		Percentage Increase in Cost/Ton Due to Improved Data

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- <u>Leak frequency over-estimated</u>

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- **<u>Emissions over-estimated at Well Sites, Leak frequency</u>**
  - ERG used 1995 EPA leak frequency data
    - Old dataset, included non-Well Site sources
    - Found +/- 4 leaks/site initially
  - API study data based on two-year study of quarterly LDAR at over 6,000 surveys across 3,482 sites from 13 operators
    - Found less than 2 leaks/site initially and dropped to less than 1 leak/site over time
  - ERG data overstates actual leak rates
  - NMOGA did not include impact in its analysis (conservative)

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- **NMED Rebuttal**. The leak frequencies API generated from the OOOOa report is not representative of NM since the facilities being surveyed are the new and modified facilities subject to the LDAR requirements in OOOOa and that they are not representative of the older facilities and sites in NM.
- **Response**
  - While I agree that the facilities in API's frequency analysis are newer than many of the NM facilities, they are no less representative than leak frequencies developed decades ago that were based on even older data and included industries besides the oil and gas segments targeted by this rule making.

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- **NMED Rebuttal**. NMOGA does not provide a detailed comparison of the results of that study to the frequency or emission rates that were the basis of the 2016 CTG estimates of cost effectiveness.
- **Response**
  - NMOGA provided the published study paper and supplementary information (Exhibit NMOGA5 & NMOGA 14) in their exhibits and the comparison to various other leak frequencies and emission rates are clearly discussed in the material provided.
  - For convenience, the comparisons are:
    - 2016 CTG leak frequency – approximately 1.18% of components leaking
    - API study leak frequency – 0.42% of components leaking
    - API's study leak rate per leaking component are higher overall than those underpinning the 2016 CTG leak rate. However, using the API study leak frequency and leak rates per leaking component to develop emission factors and component counts, the total emissions calculated based on the resulting emission factors are about **35% lower** than would be calculated using the component emission factors underpinning the 2016 CTG.

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- <u>**Costs under-estimated at Well Sites**</u>

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- **<u>Costs under-estimated at Well Sites</u>**
  - ERG used EPA 2016 CTG cost data
  - API comments on 2016 CTG:
    - Underestimated cost for:
      - Conducting leak surveys
      - Completing repairs
      - Maintaining records
    - Omitted costs for:
      - Personnel training
      - Travel time/costs
      - Equipment maintenance

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- **Costs under-estimated at Well Sites**
  - ERG Model Plant (semi-annual surveys – emissions held constant)
    - ERG costs $2,592/ton
    - API costs $7,253/ton
  - NMOGA Model Plant
    - ERG cost $3,124/ton
    - API cost $8,751/ton (180% increase)

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- **NMED Rebuttal**: EPA fully responded to API's comments in their responses to comments and it is beyond the scope of this rule making for NMED to revisit the issue.
- **Response**
  - NMOGA included the API costs in a sensitivity analysis only and did not use it in the analysis of costs per ton of reduction using the GHGRP based model plants.
  - NMOGA included the sensitivity analysis using the API costs to illustrate the impact of cost per LDAR survey on the cost per ton of reductions. Costs do matter.
  - NMOGA does believe the costs are underestimated in this rule making and that the agency undertaking the rule making has the obligation to gather and use the most current and accurate information available in their analysis – costs and other data.
  - NMOGA would be happy to assist NMED in gathering current cost information from NM operators which would be representative of actual NM operations and challenges.

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- **<u>Gathering and Boosting Stations</u>**

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- **<u>Emissions over-estimated at Gathering and Boosting Stations, Model Plant</u>**
  - ERG's Model Plant
    - Based on 1996 EPA/GRI study
      - Not representative of current population of G&B Stations
  - NMOGA Model Plant
    - Based on CO State Univ/Dept. of Energy 2019 major study
      - Fewer equipment, fewer components, lower potential leak emissions than ERG used

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Gathering andBoosting Facility Model Plant Based On Colorado State University - Dept. of Energy Study (CSU/DOE) - Gathering and Boosting Compressor Stations											
Equipment	Model Plant Equipment Count[a]	Average Component Count per Equipment[b]					Average Component Count per Model Plant[c]				
		Valves	Connectors - Flanged	Connectors - Threaded	OpenEnded Lines	Pressure Relief Valves	Valves	Connectors - Flanged	Connectors - Threaded	Open-Ended Lines	Pressure Relief Valves
AGRU	0.5	50.1	53	128	0.571	5	25.05	26.5	64	0.2855	2.5
Separators	0.153	11.3	16.6	31.3	0.225	1.2	1.7289	2.5398	4.7889	0.034425	0.1836
Yard Piping	1.79	61.8	85.7	180	0.881	2.58	110.622	153.403	322.2	1.57699	4.6182
Compressors	2.68	23.6	71.6	140	0.622	3.93	63.248	191.888	375.2	1.66696	10.5324
Dehydrators	0.532	23.1	21.2	128	0.46	2.54	12.2892	11.2784	68.096	0.24472	1.35128
Tank	0.79	5.13	4.44	35.4	0.278	1.63	4.0527	3.5076	27.966	0.21962	1.2877
Total							217	389	862	4	20

[a]From Table-6 in the CSU/DOE gathering and boosting station study; Zimmerle, Daniel, Bennett, Kristine, Vaughn, Timothy, Luck, Ben, Lauderdale, Terri, Keen, Kindal, Harrison, Matthew, Marchese, Anthony, Williams, Laurie, and Allen, David. Characterization of Methane Emissions from Gathering Compressor Stations: Final Report. United States: N. p., 2019. Web. doi:10.2172/1506681.
[b]From Tables S3-30 thru S3-35 in the CSU/DOE gathering and boosting station study; Zimmerle, Daniel, Bennett, Kristine, Vaughn, Timothy, Luck, Ben, Lauderdale, Terri, Keen, Kindal, Harrison, Matthew, Marchese, Anthony, Williams, Laurie, and Allen, David. Charactierization of Methane Emissions from Gathering Compressor Stations United States: N. p., 2019. Web. doi:10.2172/1506681.; Supplementary Information Volume 3
[c]Calculated: Equipment Count per Model Plantstation X Average Component Count per Equipment

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Table 9-9. Average Component Count for the Oil and Natural Gas Production Gathering and Boosting Station Model Plant

Equipment	Model Plant Equipment Counts	Average Component Count per Equipment[a]				Average Component Count per Model Plant			
		Valves	Connectors	Open-Ended Lines	Pressure Relief Valves	Valves	Connectors	Open-Ended Lines	Pressure Relief Valves
Separators	11	22	68	4	1	242	748	44	11
Meters/Piping	7	13	48	0	0	91	336	0	0
Gathering Compressors	5	71	175	3	4	355	875	15	20
In-Line Heaters	7	14	65	2	1	98	455	14	7
Dehydrators	5	24	90	2	2	120	450	10	10
					Total	906	2,864	83	48

[a] Data Source: EPA/GRI. Methane Emissions from the Natural Gas Industry, Volume 8: Equipment Leaks, Tables 4-4 and 4-7, June 1996. (EPA- 600/R-96-080h).

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- **Emissions reductions over-estimated at G&B**

VOC Tons per Year Reduced per Gathering and Boosting Site			
OGI Inspection Frequency	ERG Estimated	NMOGA Estimated	
		San Juan	Permian
Annual	3.91	0.697	1.733
Semiannual	5.86	1.046	2.599
Quarterly	7.81	1.395	3.465
Monthly[a]	Not Shown	1.569	3.898
Monthly Calculated	8.78		

[a]NMOGA developed the reduction percent for monthly OGI surveys from the ERG Method-21 percent of 92% minus 2% which accounts for the difference between OGI and Method-21 percent for quarterly OGI surveys.

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- <u>**Emissions reductions over-estimated at G&B**</u>
  - Differences in potential emissions reduction are significant
    - For quarterly OGI surveys:
      - San Juan sites – 82.1% lower
      - Permian sites – 55.6% lower
  - Board should use more recent and relevant CSU/DOE data

Sample Calculation						
(7.81	-	1.395)	/	7.81	* 100 =	82.1%
ERG VOC TPY G&B sites Quarterly		NMOGA VOC TPY G&B sites Quarterly San Juan Basin		ERG VOC TPY G&B sites Quarterly		Percentage of Overestimation in Emissions Reduction Due to Improved Data

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- **NMED Rebuttal.** NMOGA fails to note the findings of the study that "the study indicates that study emission factors either agree with, or are larger than, current greenhouse gas reporting program (GHGRP) emission factors for the western U.S.". The NMOGA analysis also does not take into account the estimated leak rates (in standard cubic feet per hour), including the presence of large emitters relative to those that were the basis of the 2016 CTG estimates.
- **Response**
  - NMOGA used the emission factors (Table 4: Whole Gas Average Emission Factors in the CSU/DOE gathering and boosting study final report – Exhibit NMOGA28) developed by the study authors to calculate potential equipment leak emissions and the frequency dependent reduction percentages used by ERG/NMED in our analysis. Since NMOGA used emission factors developed from the study measurements and these emission factors incorporate the study measurements, including large emitters, the Division's comments are not valid or relevant.

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- **NMED Rebuttal.** NMOGA does not provide any details regarding how the results of the second paper (CSU/DOE study) were used to adjust the VOC reduction estimates from those in the 2016 CTG to those in NMOGA's testimony, or how they were used to adjust the cost per ton of VOC reduced.
- **Response**
  - NMOGA supplied the CSU/DOE study report and relevant supplementary material as part of our exhibits. (Exhibits NMOGA28 & NMOGA7 respectively). NMED responded to these materials and clearly had access.
  - Following are the details of how NMOGA used the CSU/DOE study information to construct a more current model plant for Gathering and Boosting facilities and then to calculate potential emissions, frequency dependent reductions, and costs per ton of reduction.
    - NMOGA used the major equipment per G&B station (Table-6 in the CSU/DOE gathering and boosting station study final report – Exhibit NMOGA28) to establish the count of major equipment per type per station.
    - NMOGA used the component counts per piece of major equipment (Tables S3-30 thru S3-35 in the CSU/DOE gathering and boosting station study supplementary information Volume 3 - Exhibit NMOGA7) multiplied by the count of major equipment to calculate the number of components (e.g. valves) per station.

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- **NMED Rebuttal (continued) .** NMOGA does not provide any details regarding how the results of the second paper (CSU/DOE study) were used to adjust the VOC reduction estimates from those in the 2016 CTG to those in NMOGA's testimony, or how they were used to adjust the cost per ton of VOC reduced.
- **Response (continued)**
  - NMOGA then multiplied the components counts by the study derived emission factors (Table 4: Whole Gas Average Emission Factors in the CSU/DOE gathering and boosting study final report – Exhibit NMOGA28) to calculate the standard cubic feet of emissions per model station.
  - NMOGA then divided the scf of emissions by 1,000 to convert the scf to mscf of emissions and then multiplied the result by the lbs of VOC per mscf in the San Juan and Permian basins respectively to arrive at the mass of emissions per station. Note that the result is based on actual NM data and is certainly more representative than the outdated and non-representative information used by ERG/NMED.
  - The mass of emissions per station, which represents potential equipment leak emissions, was then multiplied by the same reduction factors used by ERG/NMED for the different OGI LDAR survey frequencies to calculate reductions per station. The reduction factors used were:
    - 40% reduction for annual surveys
    - 60% reduction for semiannual surveys
    - 80% reduction for quarterly surveys
  - 90% reduction for monthly surveys (For the monthly OGI survey frequency, NMOGA used 90% reduction which is the Method 21 monthly reduction percentage stated by ERG minus the 2% differential for quarterly OGI surveys vs. quarterly Method 21 surveys.)
  - NMOGA then used the ERG/NMED costs for the different leak survey frequencies to calculate the cost per ton of reduction for each leak frequency

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- **NMED Rebuttal.** Given the uncertainty regarding the costs used by ERG/NMED in their analysis of the rule impacts NMOGA does not think considering the minimally lower costs associated with less components and less leaks is particularly relevant to the cost per ton of reduction.
- **Response**
  - As the Division knows, major parts of the cost per survey are:
    - buying the camera and support equipment necessary
    - training the personnel conducting the surveys
    - traveling to and from the sites (especially remote sites in New Mexico)
    - warming up and checking the equipment
    - conducting the survey
    - documenting the survey results in a database
    - creating a workorder to repair any leaks found
    - obtaining parts for repair and planning the personnel for repair
    - traveling to and from the sites to make repairs
    - making the repairs
    - documenting the repairs in a database

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- **NMED Rebuttal (continued) .** Given the uncertainty regarding the costs used by ERG/NMED in their analysis of the rule impacts NMOGA does not think considering the minimally lower costs associated with fewer components and fewer leaks is particularly relevant to the cost per ton of reduction.
- **Response (continued)**
  - The only part of the cost per survey that vary with number of components per site is the survey time and the cost per survey is not particularly sensitive to the difference in survey time given the other cost drivers and the fact that the G&B station is still complex and takes about the same time to survey.
  - The only parts of the cost per survey that vary with the number of leaks are obtaining the parts for repair and making the actual repairs. Although fewer leaks will require fewer repairs the cost differential will not be that great. Also, as the Division knows, as the frequency of survey increases the number of leaks per survey goes down and the proportion of the survey cost attributable to repairs decreases to a point that the differential in costs for fixing 1 leak vs. 3 is not that relevant.

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- <u>Emissions reductions over-estimated at G&B</u>

Costs of VOC Reductions - $ per ton of VOC reduced - Gathering and Boosting Sites			
	ERG	NMOGA Estimated	
Frequency	New Mexico	San Juan	Permian
Annual	$2,067	$11,588	$4,665
Semiannual	$2,400	$13,443	$5,412
Quarterly	$3,333	$18,661	$7,512
Monthly	$6,238	$49,763	$20,032

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- **Emissions reductions over-estimated at G&B**
  - Impact on $/ton of VOC reductions (ERG cost basis while using data that better characterizes NM operations for emissions reduction potential)
    - For quarterly OGI surveys:
      - San Juan sites – 460.0% higher
      - Permian sites – 125.4% higher
    - ERG's $/ton estimates understate NM actuals

Sample Calculation						
(18,661	-	3,333)	/	3,333	=	460%
NMOGA Cost/Ton G&B Semiannual Survey San Juan Basin		ERG Cost/Ton G&B Semiannual Survey San Juan Basin		ERG Cost/Ton G&B Semiannual Survey San Juan Basin		Percentage Increase in Cost/Ton Due to Improved Data

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- <u>**Incremental analysis**</u>

20.2.50.116 LDAR

- **What cost ($/ton) for more frequent LDAR?**
- NMOGA supports LDAR but at frequencies that are reasonable
  - Additional LDAR surveys costs are scalable
  - Total cost of surveys is driven primarily by cost to perform survey (not associated repair)
  - More frequent LDAR results in lower per survey emission reduction
  - Combination drives incremental $/ton to unreasonable levels
  - Let's explore the impacts further…

20.2.50.116 LDAR

- **LDAR frequencies for Well Sites**

Frequency	NMED	NMOGA
Annually	<2 TPY	<10 TPY
Semiannually	=>2 to <5 TPY	=>10 to <25 TPY
Quarterly	=>5 TPY or more	=>25 TPY or more

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- **What cost ($/ton) for more frequent LDAR?**
- What is an incremental analysis of more frequent LDAR?
- Cost component:
  - More frequent LDAR surveys cost more money
  - Mostly Scalable (three times more frequent +/- three times more costly)
  - Slightly less than scalable due to fewer leaks discovered and repaired
  - Repair is small part of total cost of LDAR – Driver is cost of the survey itself and other non-variable costs such as an OGI camera, personnel training, travel to/from the sites, etc.

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- **What cost ($/ton) for more frequent LDAR?**
- What is an incremental analysis of more frequent LDAR?
- Emissions reduction component:
  - More frequent LDAR surveys results in lower emissions reduction per survey (NSPS Tech Support Doc data table above)

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- **<u>What cost ($/ton) for more frequent LDAR?</u>**
- What is an incremental analysis of more frequent LDAR?
- Higher cost for lower emissions reduction yields a cost/benefit from higher frequency surveys that are very high
- Let's explore the details…

20.2.50.116 LDAR

- **What cost ($/ton) for more frequent LDAR?**
- Well Sites – Annual to Semi-annual

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Annual to Semiannual	**Incremental VOC Reductions (tpy)**	**Incremental Annual Cost (2019)**	**Incremental Cost per Ton**
NG Well Site	0.255	$ 1,005	$3,947
Oil Well Site (GOR < 300)	0.048	$ 1,005	$21,028
Oil Well Site (GOR > 300)	0.061	$ 1,005	$16,448

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- **<u>What cost ($/ton) for more frequent LDAR?</u>**
- Well Sites - Annual to Quarterly:

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Annual to Quarterly	**Incremental VOC Reductions (tpy)**	**Incremental Annual Cost (2019)**	**Incremental Cost per Ton**
NG Well Site	0.509	$3,016	$5,923
Oil Well Site (GOR < 300)	0.096	$3,016	$31,553
Oil Well Site (GOR >= 300)	0.122	$3,016	$24,681

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- **<u>What cost ($/ton) for more frequent LDAR?</u>**
- Well Sites – Semi-annual to Quarterly

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Semiannual to Quarterly	Incremental VOC Reductions (tpy)	Incremental Annual Cost (2019)	Incremental Cost per Ton
NG Well Site	0.255	$ 2,011	$7,899
Oil Well Site (GOR < 300)	0.048	$ 2,011	$42,078
Oil Well Site (GOR > 300)	0.061	$ 2,011	$32,913

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- **Gathering and Boosting Stations, Gas Plants and Transmission Compressor Stations**

Frequency	NMED	NMOGA
Semi-annually	N/A	<25 TPY
Quarterly	<25 TPY	=>25 TPY
Monthly	=>25 TPY	N/A

20.2.50.116 LDAR

- **What cost ($/ton) for more frequent LDAR?**
- Gathering and Boosting Stations:

Incremental Cost per Ton of VOC Reduction			
	ERG Costs & Reductions	NMOGA Costs & Reductions	
	New Mexico	San Juan	Permian
Annual to Semiannual	$3,068	$17,154	$6,905.55
Semiannual to Quarterly	$6,136	$34,313	$13,813.14
Annual to Monthly	$9,586	$80,303	$32,326.67
Semiannual to Monthly	$13,940	$122,402	$49,274.08
Quarterly to Monthly	$29,627	$298,580	$120,195.96

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- NMED expressed concern that tying LDAR requirements to NSPS programs may be inadequate should those federal requirements change or be rescinded.
- NMOGA suggests that NMED adopt the federal requirements as of a certain date to freeze the requirements as desired.

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- **Occupied area**
- OXY's (& EDF) proposed increased LDAR frequency on Well Sites within 1000' of occupied areas is not needed and does not seem to recognize that the OCD's new Waste Rule now requires weekly or monthly documented AVOs on all such locations.
- With this new requirement in place, the increased LDAR frequency will result in a lot more cost with very little in emission reduction as results.

20.2.50.116 LDAR

- **Occupied area**
- The main driver for LDAR costs is the cost of the surveys themselves.
- Monthly LDAR leads to astronomical incremental cost ($/ton) for emissions reduction.
- Well Sites will be the most impacted. For gas Well Sites that should normally be required to perform annual LDAR, the incremental emissions reduction costs ($/ton) range from $18,519/ton to $68,904/ton.
- None of these incremental costs are reasonable, especially when AVOs are already required at least monthly and for many wells weekly.

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- **Occupied area**

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Annual to Monthly	**Incremental VOC Reductions (tpy)**	**Incremental Annual Cost (2019)**	**Incremental Cost per Ton**
NG Well Site	0.636	$11,786	$18,519
Oil Well Site (GOR < 300)	0.119	$11,786	$98,655
Oil Well Site (GOR > 300)	0.153	$11,786	$77,168

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- Occupied area

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Semiannual to Monthly	Incremental VOC Reductions (tpy)	Incremental Annual Cost (2019)	Incremental Cost per Ton
NG Well Site	0.382	$10,781	$28,234
Oil Well Site (GOR < 300)	0.072	$10,781	$150,407
Oil Well Site (GOR > 300)	0.092	$10,781	$117,648

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- Occupied area

Incremental cost per ton of VOC reduction - ERG Costs & NMOGA Reductions			
Quarterly to Monthly	Incremental VOC Reductions (tpy)	Incremental Annual Cost (2019)	Incremental Cost per Ton
NG Well Site	0.127	$8,771	$68,904
Oil Well Site (GOR < 300)	0.024	$8,771	$367,065
Oil Well Site (GOR > 300)	0.031	$8,771	$287,117